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Commissioning

Commissioning?

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Ship naming and launching endow a ship hull with her identity, but many milestones remain before she is completed and considered ready to be designated a commissioned ship. The engineering plant, weapon and electronic systems, galley, and multitudinous other equipment required to transform the new hull into an operating and habitable warship are installed and tested. The prospective commanding officer, ship's officers, the petty officers, and seamen who will form the crew report for training and intensive familiarization with their new ship.

Prior to commissioning, the new ship undergoes sea trials during which deficiencies needing correction are uncovered. The preparation and readiness time between christening-launching and commissioning may be as much as three years for a nuclear-powered aircraft carrier to as brief as twenty days for a World War II landing ship.

Source: Wikipedia

Commissioning?

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Verify that the building's energy related systems are installed, calibrated and perform according to the owner's project requirements, basis of design, and construction documents.

- LEED® for New Construction, Version 2.2

Commissioning?

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[redacted]

Building commissioning provides documented confirmation that building systems function according to criteria set forth in the project documents to satisfy the owner's operational needs.

- *Building Commissioning Association*

BCxA™
Building Commissioning Association

Commissioning?

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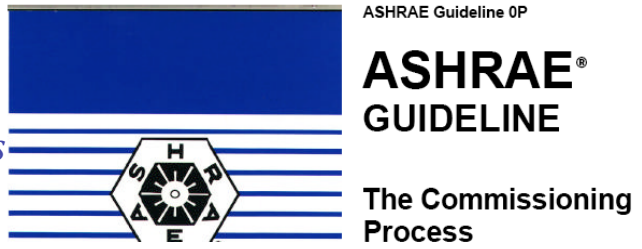
A quality-focused process for enhancing the delivery of a project. The process focuses on verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

ASHRAE Guideline 0, The Commissioning Process



Commissioning?

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[redacted]

1. Help the Owner identify how they need the building to perform.
2. Make sure the building is designed to perform to those needs.
3. Make sure the building is built to perform to those needs.
4. Make sure the Owner can keep it that way.

- Michael Mantai

LEED ® Energy & Atmosphere

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[redacted]

Prerequisites:

1. Fundamental Commissioning of the Building Energy Systems
2. Minimum Energy Performance
3. Fundamental Refrigerant Management

Credits:

1. Optimize Energy Performance (1-10 points)
2. On-Site Renewable Energy (1-3 points)
3. Enhanced Commissioning (1 point)
4. Enhanced Refrigerant Management (1 point)
5. Measurement & Verification (1 point)
6. Green Power (1 point)

Prerequisite 1
Fundamental Building Systems Commissioning

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[redacted]

Engage a commissioning team that does not include individuals directly responsible for project design or construction management.

Cx Models

- o Designer
- o Owner
- o Contractor
- o Third Party Consultant
- o Mix of above

Need for Commissioning

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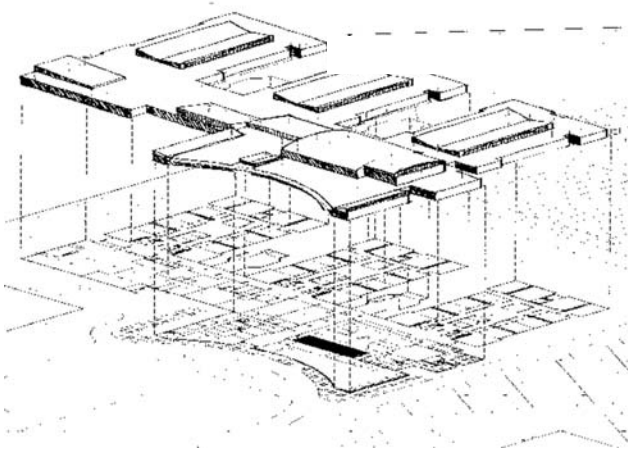
- New environment for construction
  - Less skilled labor
  - Lower design fees
  - Faster schedules
  - Complicated Systems
  - System Integration
  - Cheaper materials
  - Competition
  - Attention to Indoor Air Quality
  - Mold Concerns



Need for Commissioning

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- End result is often:
  - Projects occupied before proper "functional" completion
  - Delayed projects
  - Problematic systems
  - Poor indoor air quality and sick buildings
  - Costs to Owner to troubleshoot and fix problems
  - Wastes of energy
  - Owner not properly trained and equipped with information to maintain building

What is Substantial Completion???

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[redacted] MEMBER

CxA Building Commissioning Association Member

Goals of Cx

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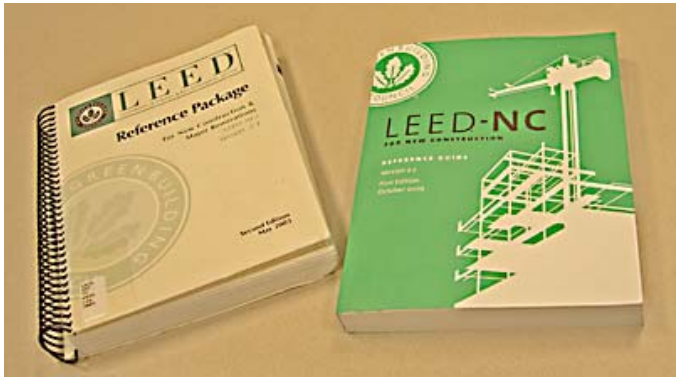
From LEED® NC v2.2 EA Prerequisite 1:

> Benefits of commissioning include reduced energy use, lower operating costs, reduced contractor callbacks, better building documentation, improved occupant productivity, and verification that the systems perform in accordance with the owner's project requirements.



Goals of Cx

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[redacted]

- Identify and Document Owner's Requirements before design.
- Ensure design meets requirements, is fully coordinated, allows for maintainability and operability, and allows for commissioning.
- Ensure submitted equipment meets requirements.
- Improve construction schedule.

Goals of Cx

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[redacted]

- Functionally check, test, retest, and document all systems, controls, sequences, and interactions between systems.
- Fully train Owner's staff.
- Equip Owner with complete, thorough, and understandable operating and maintenance information
- Test opposed season operations
- Assess building again after occupancy
- Ongoing commissioning

Systems that must be commissioned per LEED®–

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Energy related:

- HVAC and controls
- Domestic hot water
- Lighting controls
- Renewable energy

The Economics of Commissioning

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[redacted]

If planned correctly and implemented early enough in the design process, commissioning can be included with little or no cost impact*.

Design Phase Costs | Construction Phase Costs | First Year Warranty Period Costs

Design Phase Costs | Construction Phase Costs | First Year Warranty Period Costs

* Based on research findings from University of Wisconsin, ASERTTI Training Module, 1998

The Economics of Commissioning

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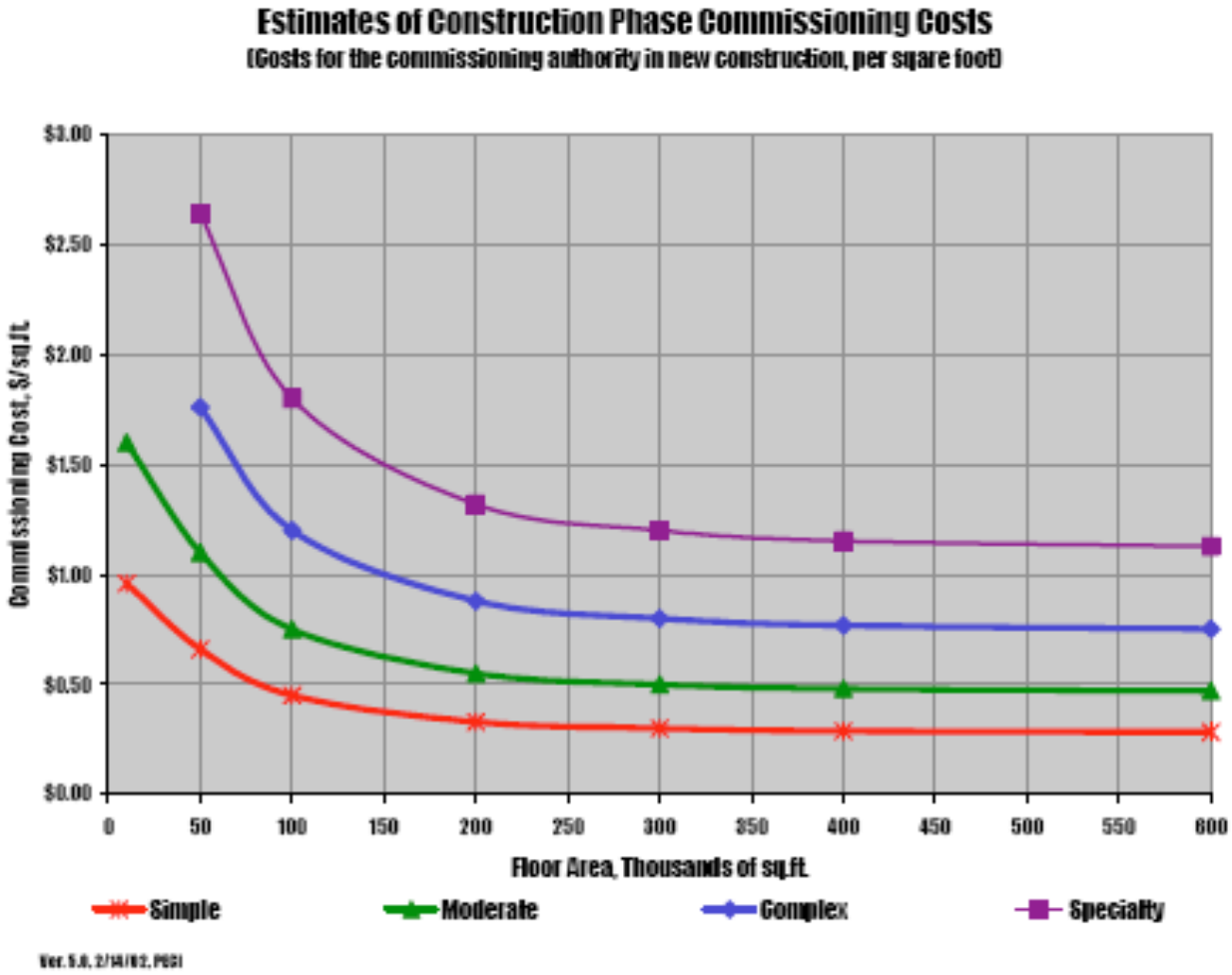

The Economics of Commissioning

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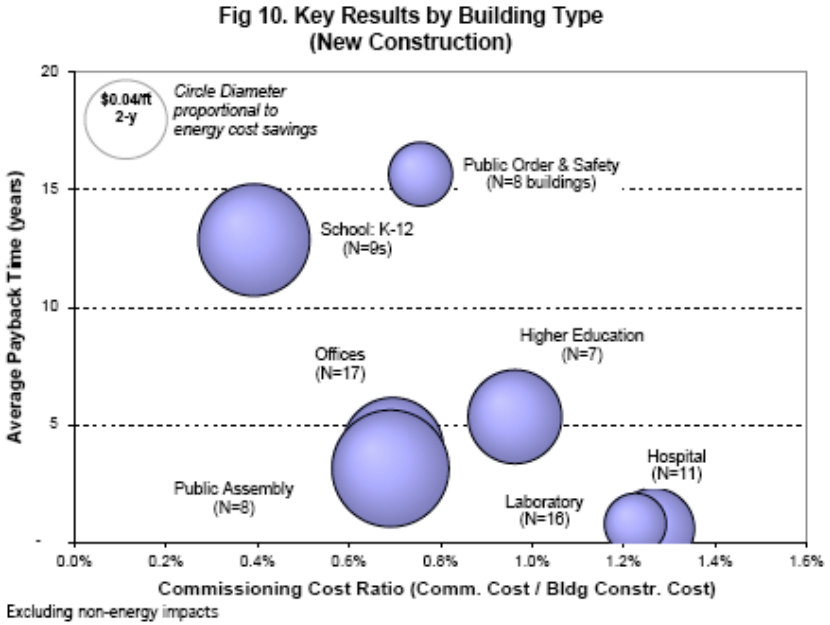
- Cost savings-hard dollars:
  - Reduced change orders
  - Energy cost 5-10% less ($.15-$.50/SF)
  - Maintenance cost less
- Cost savings-intangibles
  - Increased IAQ/productivity
  - Reduced absenteeism



Cx - Benefit and Impact

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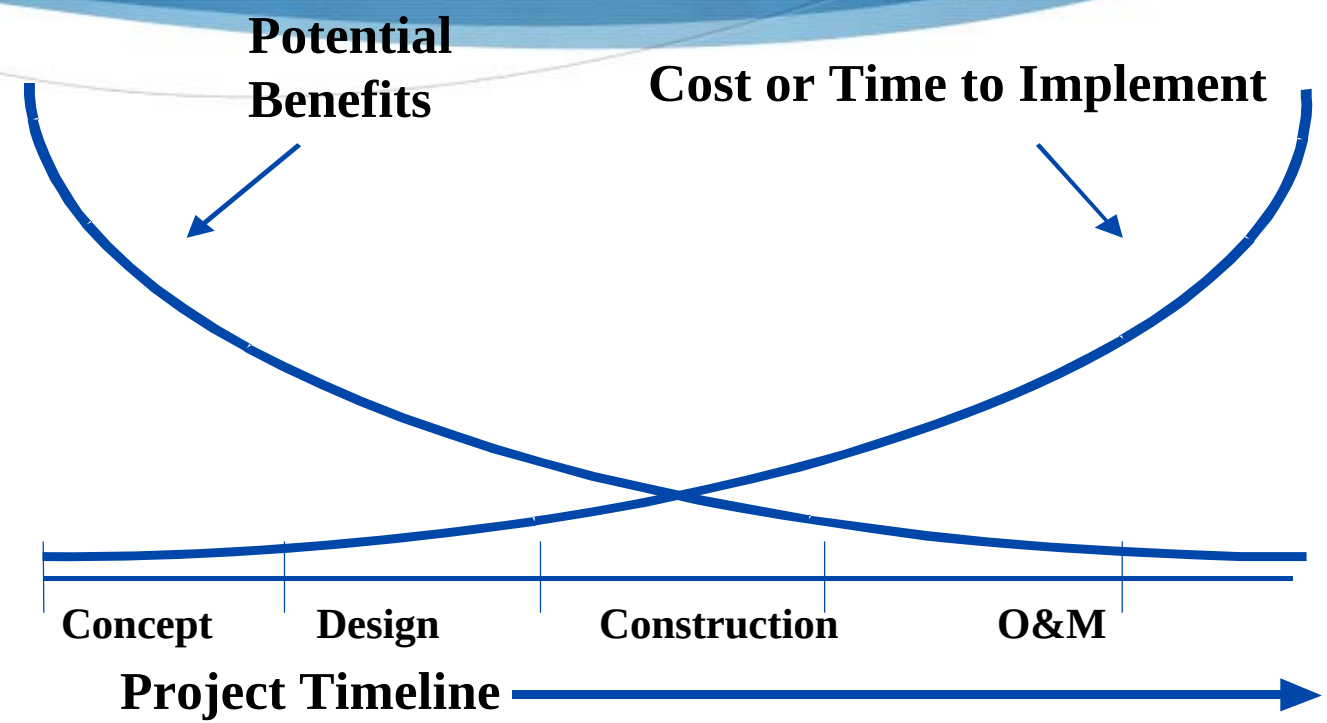
[redacted]



Why Recommission?

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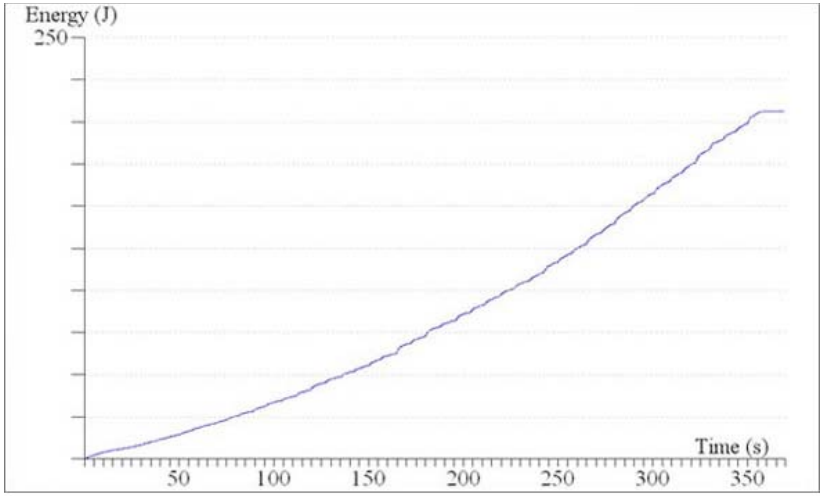
[redacted]

Almost 75% of the increase in energy use was caused by significant component failures and/or control changes (related to other building problems)…the remainder was due to control changes implemented by the operators.

- Excerpt from 12/04 study



What is Recommissioning?

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[redacted]

‘Third-party commissioning agent’ means a person accredited by the USGBC or GBI, with expertise in building system performance, who will analyze, evaluate, and confirm the proper function and performance of a high performance building, its systems, equipment, and indoor air quality, **and who did not participate in the original certification of the major facility project or renovation project.**

The third-party commissioning agent shall determine whether the building is operating at the standard to which it was originally designed and certified.

What is Recommissioning?

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[redacted]

- Observe system components
- Check sensor calibrations
- Retest controls sequences
- Review utility bills
- Measurement & Verification?

Bottom Line: Verify building still performing at same level.

LEED® EA Credit 1 - Optimize Energy Performance

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[redacted]

New Building	Existing Building	Points
10.5%	3.5%	1
14%	7%	2
17.5%	10.5%	3
21%	14%	4
24.5%	17.5%	5
28%	21%	6
31.5%	24.5%	7
35%	28%	8
38.5%	31.5%	9
42%	35%	10

LEED® EA Credit 1 - Optimize Energy Performance

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[redacted]

- Buildings < 100,000 SF (excluding health care and laboratories) can now follow prescriptive measures for up to 5 points: Advanced Buildings™ Core Performance Guide
- Other buildings must use energy model approach
- Energy model can be used for Life Cycle Cost Analysis

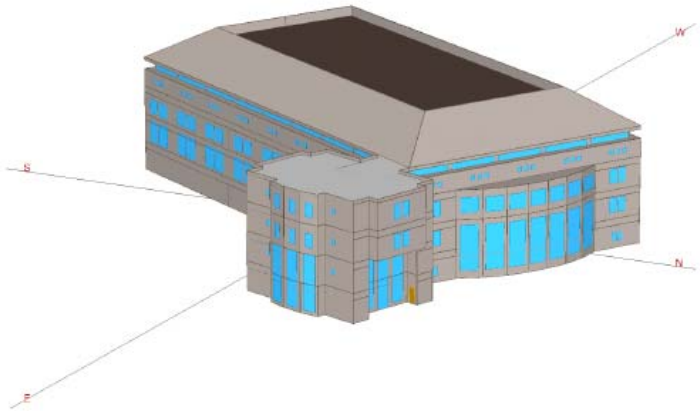
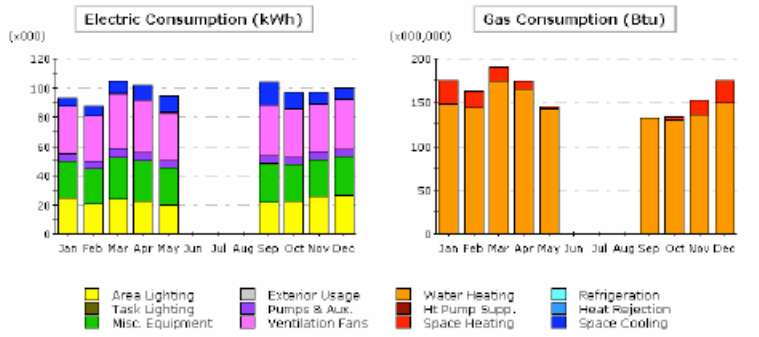


Figure 8, 3-D view of eQUEST model



LEED® EA Credit 5 - Measurement & Verification

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Develop and implement a Measurement and Verification (M&V) plan consistent with… the International Performance Measurement & Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction.

Metering or energy breakdown for the following end-uses:

- Lighting loads
- Plug loads
- Constant and variable motor loads
- Variable frequency drive (VFD) operation
- Chiller and boiler efficiency at variable loads (kW/ton)
- Cooling and heating load
- Air and water economizer and heat recovery cycles
- Air distribution static pressures and ventilation air volumes
- Building-related process energy systems and equipment
- Water use

Measurement & Verification vs. Recommissioning

"The report must include, but is not limited to, **the building's savings on energy and water**, the level of its indoor air quality, the existing system's function and performance, problems with the system, and whether the system's performance meets the facility's requirements."

Energy Model and Measurement & Verification will greatly facilitate this effort.

Resources

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[redacted]

Green Building and Energy

- www.usgbc.org (U.S. Green Building Council)
- www.betterbricks.com
- www.energystar.gov (DOE Energy Star program)
- www.doe.gov (Department of Energy)

Commissioning

- www.bcxa.org (Building Commissioning Association)
- www.peci.org (Portland Energy Conservation, Inc.)
- www.cacx.org (California Commissioning Collaborative)

Energy Modeling

- www.doe2.com (DOE-2 modeling software)

Renewable Energy

- www.nrel.gov (National Renewable Energy Lab)
- www.seia.org (Solar Energy Industries Association)
- www.awea.org (American Wind Energy Association)

Measurement & Verification

- www.ipmvp.org (International Performance Measurement and Verification Protocol)